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| EXAMINER | |
|---|---|
| BAND, MICHAEL A | |

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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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| Office Action Summary | Application No. 10/798,331 | Applicant(s) KADLEC ET AL. | |
|---|---|---|---|
| | Examiner Michael Band | Art Unit 1753 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *12 March 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-48* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-48* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *8/10/2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *7/12/2004; 10/7/2005*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

# DETAILED ACTION

## *Information Disclosure Statement*

1. The information disclosure statement filed October 7, 2005 cites an "International Search Report filed 01/06/05" as non-patent literature. Said citation has been lined-through because it is not a published document available to the public. However, the Examiner has considered the search report.

## Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 1-35, 42, 44-48 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Applicant claims a generic "field" (claim 1, lines 15 and 18), (claim 6, line 2), (claim 9, line 2), (claim 13, line 2), (claim 19, lines 4 and 5), (claim 45, lines 6 and 9), (claim 48, line 2). The "field" can refer to a number of different concepts, such as a magnetic field, electric field, open field, etc rendering the claim indefinite. The claims have been treated with respect to a magnetic field.

Furthermore claim 30 recites an evenly distributed flux and an uneven flux distribution, leading to a contradiction in the claim.

Claim 29 recites the limitation "said sputtering surface" in lines 15-16. There is insufficient antecedent basis for this limitation in the claim.

### *Claim Rejections - 35 USC § 102*

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1-3, 6-17, 19-22, 25-28, and 45-48 are rejected under 35 U.S.C. 102(b) as being anticipated by Wang (US Patent No. 6,352,629).

With respect to claims 1, 45, and 48, Wang '629 discloses a method for sputter coating a wafer (i.e. substrate) in a vacuum chamber (figure 1, part 12) via a high-density plasma (col. 4, lines 19-43). Depicted in figure 1 is a surface of a target (part 16) and a wafer with a surface (part 24) opposite of the target (col. 4, lines 28-29). Also depicted in figure 1 are two magnetic fields ($B_m$ and $B_c$) which are seen generated in the space between the target and wafer. A magnetron (figure 1, part 36) forms magnetic field $B_m$ as a closed loop with the direction towards the target surface, as indicated by the arrows, where the tangent line to the minimum peak of $B_m$ is parallel to the target surface. Figure 1 further depicts a tunnel-like arcing from an outer area of a first magnetic pole (part 42; col. 4, lines 54-56) to an inner area of a second magnetic pole (part 40; col. 4, lines 54-56), where the inner area is confined by the two magnetic fields of $B_m$ and where the magnetic field component perpendicular to the target surface at the

center of the inner magnetic pole, and thus the center of the inner area, equals zero. An unbalanced long-range asymmetrical magnetron (figure 1, part 36) has magnetic field $B_c$ that is seen coming from said outer area relative of said inner area to complement (i.e. increase) the magnetic flux where the long-range field reaches the substrate surface (figure 1; col. 5, lines 55-57) with a component of the magnetic field $B_m$ parallel to said substrate surface and magnetic field $B_m$ having a strength in the range of about 1000 gauss to 10 gauss (col. 5, lines 60-65) and magnetic field $B_c$ having a strength in the range of about 15 gauss to 100 gauss (col. 7, lines 10-17). A magnetic field $B_m$ parallel and close to the face of the target creates a high-density plasma, where the bias on the substrate attracts metal atoms from the target in the plasma (col. 4, lines 56-67; col. 5, lines 40-44). Also the unbalanced magnetron has an unillustrated motor and drive shaft aligned to a central axis (figure 1, part 38) that rotates the back plate of the magnetron in a sweeping motion in relation to the central axis (col. 4, 44-48).

With respect to claims 2 and 46, Wang '629 further discloses "a sputtering target 16 composed of the metal to be sputtered is sealed to the chamber 12 through an insulator 18. A pedestal electrode 22 supports a wafer 24 to be sputter coated in parallel opposition to the target 16 (col. 4, lines 26-29). Furthermore Wang '629 discusses how the target DC power supply (figure 1, part 34) biases the target causing the argon working gas (figure 1, part 26) to be excited into a plasma containing electrons and positive argon ions, where the positive argon ions are attracted to the negatively biased target and sputter metal atoms from the target (col. 4, lines 37-43).

With respect to claims 3 and 47, Wang '629 discloses that the magnetic field strength for $B_m$ is 10 gauss (col. 5, lines 58-64).

With respect to claim 6, Wang '629 further depicts that unbalanced magnetron (figure 1, part 36) generates a magnetic field $B_m$ coupled with magnetic field $B_c$. Furthermore the magnetic field $B_c$ represented by arrowed-lines shows an inhomogenous magnetic flux in relation to said outer area (figure 1, part 42) and inner area (figure 1, part 40).

With respect to claim 7, Wang '629 further depicts in figure 1 two electromagnets (part 40) which would thus generate an additional magnetic field $B_c$ that increases magnetic flux.

With respect to claim 8, Wang '629 further discloses that the magnets (part 40) in figure 1 are powered by DC power sources (part 42), making them electromagnets (col. 5, lines 20-28).

With respect to claims 9-11, Wang '629 further discloses the unbalanced magnetron having an unillustrated motor and drive shaft aligned to a central axis (figure 1, part 38) that rotates the back plate of the magnetron in a sweeping motion in relation to the central axis (col. 4, 44-48). The central axis is perpendicular to the substrate (figure 1, part 24) and target (figure 1, part 16) and noticeably offset from the geometric center of said inner area (figure 1, part 40). It is inherent that the magnetic field pattern sweeps along the substrate in order to effectively sputter the substrate.

With respect to claim 12, Wang '629 further depicts in figure 1 the loop of magnetic field $B_m$ being circular around an arbitrary central axis.

With respect to claim 13, Wang '629 further discloses a magnetic field $B_m$ inside the vacuum chamber parallel and close to the face of the target to create a high-density (i.e. maximum) plasma where the negative bias on the substrate attracts the positively charged metal ions in the plasma to the wafer (i.e. substrate) (col. 4, lines 37-43 and lines 54-67). Wang '629 further describes unbalanced magnetrons projecting the magnetic field towards the wafer, with magnetic field $B_c$ coming from the unbalanced magnetron to help stabilize the flow of plasma electrons, and therefore metal ions, from the target to the wafer, increasing the plasma density and leads to an increase in sputtered metal ion flux upon the wafer (col. 5, lines 29-57). An unillustrated motor and drive shaft aligned to a central axis rotates (i.e. sweeps) the back plate (and the magnetron) across the target (col. 4, lines 44-48).

With respect to claims 14 and 20, Wang '629 further discloses that the magnetic field lines extend toward the wafer (i.e. substrate) and the plasma electrons gyrate around them in a spiral pattern and travel toward the wafer, with the metal ions (i.e. current of ions) following the plasma electrons (col. 5, lines 38-44). Since the unbalanced magnetron is moving via unillustrated motor (col. 4, lines 44-48), the magnetic field intensity is constantly adjusted across the target, leading to an adjustment in plasma density in relation to the target, and therefore an adjustment of metal ion density. Furthermore Wang '629 discloses using an AC power source for the electromagnetic coil (col. 7, lines 30-37), thus a component of the magnetic field perpendicular to the wafer is adjusted resulting in an adjustment of metal ion density.

With respect to claim 15, Wang '629 further depicts in figure 1 an electromagnet (part 40) with coils generating magnetic field $B_c$ (col. 6, lines 54-57). Since magnetic field $B_c$ emitted from the electromagnet is circular by nature as seen in figure 1, the top part and bottom part of the magnetic field (not seen) are parallel to the target surface.

With respect to claim 16, Wang '629 further discloses the electromagnetic coil is powered by AC (alternating current) (col. 7, lines 30-37).

With respect to claim 17, Wang '629 further depicts in figure 1 two separate electromagnetic coils (part 40) powered by a power source (part 42) that is an AC power source (col. 7, lines 30-37). Furthermore the magnetic fields generated by each electromagnet is represented by $B_c$. The $B_c$ magnetic field directions are denoted by arrows, where the left-most side can be seen in the direction going from south to west and the right-most side can be seen going from south to east.

With respect to claim 19, Wang '629 further depicts in figure 1 that at least one wafer (i.e. substrate) (part 24) is provided in the apparatus (part 10). It is well known that semiconductor wafers are circular. Furthermore Wang '629 discloses that the vacuum chamber (part 12) includes generally cylindrical sidewalls (i.e. circular area) (figure 1; col. 4, lines 19-22). Figure 1 also depicts an unbalanced magnetron (part 36) moving the magnetic field around a central axis (part 38) of the vacuum chamber (part 12) and wafer (part 24). The magnetic field in figure 1 is seen to be along the wafer.

With respect to claim 21, Wang '629 further discloses how magnetic field lines extend toward the wafer (i.e. substrate) from the target and plasma electrons (i.e. electron current) gyrate around them in a spiral pattern and travel toward the wafer (col.

5, lines 35-44). Figure 1 further depicts the magnetic field lines being perpendicular to the target and the wafer.

With respect to claim 22, Wang '629 further discloses using an AC power supply instead of a DC power supply (col. 7, lines 32-36). Furthermore Wang '629 discusses using an RF power supply to bias the substrate with a frequency of 13.56 MHz (figure 1, part 50; col. 4, lines 61-67). It is well known that an AC (alternating current) and RF (radio frequency) power supplies constitute forms of pulsating power.

With respect to claim 25, Wang further discloses "a vacuum pumping system 30 maintains the interior of the chamber 12 at a very low base pressure of typically $10^{-8}$ Torr (0.000001333 Pa) or less" (col. 4, lines 32-34).

With respect to claims 26 and 27, Wang '629 further discloses "an Rf power supply 50, for example, having a frequency of 13.56 MHz is connected to the pedestal electrode 22 to create a negative self-bias on the wafer (i.e. substrate)" (col. 4, lines 61-64). It is known that Rf power is an oscillating (i.e. pulsing) power, thus the Rf is constantly adjusted and therefore the energy of the ions in the plasma bombarding the wafer is adjusted.

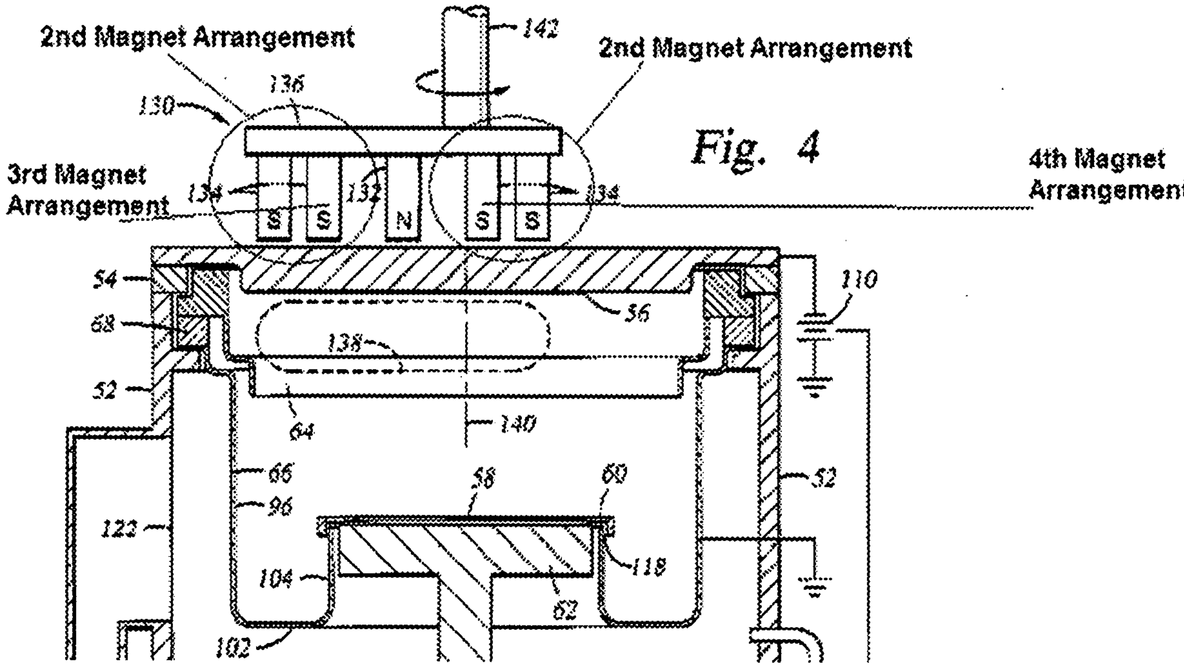
With respect to claim 28, Wang '629 further discloses a sputter reactor having a copper target (col. 6, lines 58-60).

6. Claims 29-33 and 35-41 are rejected under 35 U.S.C. 102(b) as being anticipated by Chiang et al (US Patent No. 6,398,929).

With respect to claim 29, Chiang '929 depicts in figure 4 a magnetron source (part 130) with a target (part 56), where a magnetic arrangement is seen on the back of

the target (parts 132 and 134). One first magnet subarrangement (part 132) with a "north pole" and a second magnet subarrangement (part 134) with a "south pole" (figure 4), where the outer pole (i.e. second subarrangement) producing a much higher magnetic flux than the inner pole (i.e. first magnet subarrangement) (col. 12, lines 30-33). Although no magnetic field is depicted, it is inherent that the magnetron would exhibit a magnetic field through the target for sputtering, as evidenced in figure 1 with magnetic field $B_m$ from Wang et al (US Patent No. 6,352,629). The magnetron (part 130) is rotated about the center (part 140) of the target (part 56) by a motor-driven shaft (part 142) to achieve full coverage in sputtering of the target (figure 4; col. 12, lines 9-14).

With respect to claim 30, Chiang '929 depicts in figure 4 a second magnet arrangement (part 134) which comprises a third magnet subarrangement and fourth magnet subarrangement which all contribute to the second magnet arrangement magnetic flux being uneven across the target. This is depicted in the figure below.




With respect to claims 31-33 and 35, Chiang '929 depicts an inner "south pole" (part 134) and "north pole" (part 132) which would inherently have a second area loop, as evidenced by in figure 1 with magnetic field $B_m$ from Wang et al (US Patent No. 6,352,629). The magnetron (part 130) is rotated about the center (part 140) of the target (part 56) by a motor-driven shaft (part 142) to achieve full coverage in sputtering of the target (figure 4; col. 12, lines 9-14). As seen in figure 4, the second magnet arrangement (part 134) is offset from a central axis (part 140) where the loop central axis is inherently offset from the central axis as evidenced in figure 1 with magnetic field $B_m$ from Wang et al (US Patent No. 6,352,629). The central loop axis, rotational axis, and said fourth magnet arrangement are aligned in a radial direction from said rotational axis (figure 4).

With respect to claim 36, Chiang '929 depicts in figure 4 a magnetron treatment reactor (part 50) comprising a magnetron source (part 130) including a target surface (part 56) with a magnetic arrangement (part 130) adjacent to the target. A first magnet arrangement (figure 4, part 132) and a second magnet arrangement (figure 4, part 134) are displayed in figure 4, with the outer pole (i.e. second subarrangement) producing a much higher magnetic flux than the inner pole (i.e. first magnet subarrangement) (col. 12, lines 30-33). Although no magnetic field is depicted, it is inherent that the magnetron would exhibit a magnetic field through the target for sputtering, as evidenced in figure 1 with magnetic field $B_m$ from Wang et al (US Patent No. 6,352,629). The magnetron (part 130) is rotated about the center (part 140) of the target (part 56) by a motor-driven shaft (part 142) to achieve full coverage in sputtering of the target (figure 4; col. 12, lines 9-14). A wafer (i.e. substrate) (part 58) is placed on a pedestal (i.e. carrier) (part 62) opposite from the target (part 56) surface (figure 4).

With respect to claim 37, Chiang '929 further depicts in figure 4 a shield (part 66) adjacent to the wafer pedestal (parts 58 and 62). Furthermore Chiang '929 discloses that "the grounded shield 66 also acts as the anode grounding plane (i.e. arrangement)" (col. 8, lines 54-59).

With respect to claim 38, Chiang '929 further discloses a floating shield (part 64) is held within a vacuum chamber (part 52) to protect the chamber wall (part 52) from the sputtered material, thus the floating shield confines a process area between the magnetron source and wafer (i.e. substrate) (figure 4; col. 8, lines 54-57). Futhermore Chiang '929 describes how the floating shield accumulates some electron charge and

builds up a negative potential and electrically shields the grounded shield (part 66) from the target (part 56) (col. 8, lines 54-65; col. 11, lines 8-20).

With respect to claim 39, Chiang '929 further discloses that the shield (part 66) is typically composed of stainless steel, and the inner sides may be bead blasted or otherwise roughened to promote adhesion of the copper deposited on it (col. 10, lines 62-66), thus the shield and anode arrangement are the same with the anode on the inside (i.e. hidden) of the stainless steel shield.

With respect to claim 40, Chiang '929 describes inductively coupling RF power into an electrical coil wrapped around a plasma source region between the target and the wafer (col. 3, lines 42-55), thus the coil axis is perpendicular to the target source.

With respect to claim 41, Chiang '929 further depicts in figure 1 a wafer (i.e. substrate) (part 58) supported via a pedestal (i.e. carrier) (part 62). Furthermore Chiang '929 discloses that "the pedestal 62 and hence the wafer 58 are left electrically floating, but a negative DC self-bias nonetheless develops on it. On the other hand, some designs use a controlled power supply 112 to apply a DC or RF bias to the pedestal 62 to further control the negative DC bias that develops on it" (col. 11, lines 37-48).

7. Claim 34 is rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Chiang et al (US Patent No. 6,398,929).

With respect to claim 34, Chiang '929 disclose and depicts a magnetic yoke (figure 4, part 136) that composes the back of the unbalanced magnetron. Furthermore Chiang '929 depicts the magnetic yoke as a part of the magnetron (part 130) which is

rotated about the center (part 140) of the target (part 56) by a motor-driven shaft (part 142) to achieve full coverage in sputtering of the target (figure 4; col. 12, lines 9-14). While Chiang '929 does not specifically suggest the composition of the back plate, it is either inherent or obvious that the back plate have some type of magnetic shield to limit the magnetic field exposure to the surrounding environment.

### *Claim Rejections - 35 USC § 103*

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

9. Claims 4-5 and 44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang (US Patent No. 6,352,629) as applied to claim 1 above and in further view of Chiang et al (US Patent No 6,398,929).

With respect to claims 4 and 5, Wang '629 further depicts in figure 1 that a tunnel-like magnetron field pattern $B_m$ covers a percentage, at least about 50% seen from figure 1, of the target surface. However Wang '629 is limited in that while the tunnel-like magnetron field pattern covers a percentage of the target, a specific percentage is not suggested.

Chiang '929 teaches a similar apparatus in figure 4 for sputtering a substrate with a magnetron (part 130) attached to a motor-driven drive shaft (part 142). Chiang '929 also discusses how the magnetron (part 130) is rotated about the center (part 140) of

the target (part 56) by a motor-driven shaft (part 142) to achieve full coverage (i.e. 100%) in sputtering of the target (col. 12, lines 9-13).

It would have been obvious to one of ordinary skill in the art to incorporate the full coverage (i.e. 100%) of Chiang '929 for the coverage percentage of Wang '629 since Wang '629 fails to disclose a specific coverage percentage.

With respect to claim 44, Wang '629 further discloses an SIP (self-ionized plasma) magnetron with a vacuum pump that maintains a vacuum chamber pressure of $10^{-8}$ Torr or less (col. 4, lines 32-53). However Wang '629 is limited in that this pressure is smaller and more specific, it lies outside the claimed pressure range.

Chiang '929 teaches a vacuum pump system (part 120) in figure 4 capable of a pressure of $10^{-7}$ Torr (0.00001333 Pa), with the pressure typically maintained between about 1 millitorr (0.1333 Pa) and 1000 millitorr (133.32 Pa) and to below about 5 millitorr (0.667 Pa) in SIP (self-ionized plasma) sputtering (col. 11, lines 60-67). Thus a pressure range of about 0.667 Pa and 0.00001333 Pa is established for the operation of the apparatus, encompassing the claimed range of 0.01 Pa and 0.05 Pa. Chiang '929 cites the advantage as SIP is promoted by low pressures of less than 5 millitorr, preferably less than 2 millitorr, and more preferably less than 1 millitorr with magnetron usage, thereby increasing target power density and causing the magnetic field to penetrate far toward the substrate (col. 6, lines 60-66).

It would have been obvious to one of ordinary skill in the art to use the pressure taught in Chiang '929 for the pressure of Wang '629 in order to gain the advantage of

increased target power density and farther penetration of magnetic field towards the substrate.

It has been held that in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a *prima facie* case of obviousness exists. *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976).

10. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wang (US Patent No. 6,352,629).

With respect to claim 18, Wang '629 further depicts an apparatus (part 10) for providing at least one wafer (i.e. substrate) for processing (figure 1, parts 10 and 24). However Wang '629 is limited in that while the placement for one wafer is provided, it is not suggested to provide more than one substrate.

It has been held that a mere duplication of parts has no patentable significance unless a new and unexpected result is produced. *In re Harza*, 274 F.2d 669, 124 USPQ 378 (CCPA 1960). It would have been obvious to one of ordinary skill in the art to have an apparatus capable of providing more than one substrate since the apparatus functions similarly to an apparatus with only one substrate and one of ordinary skill would have a reasonable expectation of success in making the modification.

11. Claims 23-24 and 42-43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang (US Patent No. 6,352,629) as applied to claim 22 above, and further in view of Chiang et al (USPGPub 2001/0050220).

With respect to claims 23 and 42, Wang '629 further discloses a frequency for the AC power supply as being less than 1 kHz (col. 7, lines 34-37) and an RF power

supply having a frequency of 13.56 MHz. However Wang '629 is limited in that while a frequency range is discussed, the claimed range is not specified.

Chiang '220 teaches sputtering on a substrate by ionized metal plasma deposition (abstract) utilizing a similar apparatus with a magnetron (part 106) above a substrate (110) with a vacuum pump (part 146) and shield (part 128) (figure 1). Chiang '220 also teaches an RF power source (part 134) that biases the substrate (p. 2, para 21) where the positive and negative voltage portions are sequentially alternated to result in a series of target/coil sputtering steps resulting in a frequency of between about 1 kHz and 200 kHz (p. 3, para 30). It is well known that an RF power source is a pulsating power source as evidenced by figure 2. Chiang '220 lists the advantage of using this RF bias power as to influence the direction of ions in the chamber during processing (p. 1, para 9).

It would have been obvious to one of ordinary skill in the art to use the bias RF power taught in Chiang '220 for the power source of Wang '629 in order to gain the advantage of influencing the direction of the ions during processing.

It has been held that in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" *a prima facie* case of obviousness exists. *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976).

With respect to claims 24 and 43, Wang '629 further discloses frequencies for an AC power source and a RF power source (col. 4, lines 61-67; col. 7, lines 30-37), with both power sources being pulsating. It is well known that a pulsating power source has a duty cycle or ratio associated with it. However Wang '629 is limited in that while it is

inherent that a duty cycle or ratio is incorporated with an AC or RF power source, a specific duty cycle or ratio is not specified.

Chiang '220 further teaches a duty cycle associated with the frequency range discussed earlier. Chiang '220 discusses a duty cycle between about 50% and about 90%, leading to a conclusion that the off-time must therefore be from about 50% and about 10%. Chiang '220 lists the advantage of using this RF bias power, and therefore the duty cycle, as to influence the direction of ions in the chamber during processing (p. 1, para 9).

It would have been obvious to one of ordinary skill in the art to use the duty cycle taught in Chiang '220 for the duty cycle of Wang '629 in order to gain the advantage of influencing the direction of the ions during processing.

It has been held that in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" *a prima facie* case of obviousness exists. *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976).

### ***Conclusion***

12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. US Patent No. 4,422,896; US Patent No. 5,069,772; US Patent No. 5,423,970; US Patent No. 5,744,011; US Patent No. 6,155,200; US Patent No. 6,306,265; US Patent No. 6,663,754 as being related to the state of the art.

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael Band whose telephone number is (571) 272-9815. The examiner can normally be reached on Mon-Fri, 8am-4pm, EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexa Neckel can be reached on (571) 272-1446. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

14. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

MAB
MB

Alexa Neckel
ALEXA D. NECKEL
SUPERVISORY PATENT EXAMINER